

Cichlid fishes from the La Plata basin.
Part II. *Apistogramma commbrae*
(Regan, 1906) (Teleostei: Cichlidae)

by

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With 2 figures

ABSTRACT

Cichlid fishes from the La Plata basin. Part II. *Apistogramma commbrae* (Regan, 1906) (Teleostei: Cichlidae).—*Apistogramma commbrae* is a small cichlid species in the Paraguay river system, ranging from Brazilian headwaters southwards to at least about Asunción in the republic of Paraguay. Characteristics of this species include a dark spot on the caudal peduncle, confluent with the caudal base spot, stripes along the abdominal sides, and a modal number of 16 dorsal spines. Five of 34 specimens examined have four instead of three anal spines. Junior synonyms are *Heterogramma commbrae* Regan, 1906, *H. corumbae* Eigenmann & Ward, 1907, and *H. corumbae* Ribeiro, 1918.

INTRODUCTION

The South American cichlid genus *Apistogramma* comprises about 50 species, most of them found in the Amazonas basin. Eight nominal species and one undescribed form have been reported for the La Plata drainage system (Rio Paraguay system and adjacent parts of the Paraná medio and Alto Paraná). These were excluded from my recent revision of the genus for want of adequate material (KULLANDER 1980a). Although some opinions were expressed in that paper concerning synonymies and relationships, they need to be substantiated, and several problems remain to be investigated. Below, I describe *A. Commbrae* on recently collected material. The relationships of this species were incorrectly conceived in KULLANDER (1980a), and the problem of its scientific name remains to be solved.

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This is the second report on the cichlids of the Expedition of the Muséum d'Histoire naturelle de Genève to Paraguay, 1979 (earlier paper KULLANDER 1981), and my sixth paper on the genus *Apistogramma* (KULLANDER 1976, 1979a, b, 1980a, c). Part of the work was carried out at the University of Umeå (1974-1976), at the British Museum (Natural History), London (1975, 1979), and at the Museu de Zoologia da Universidade de São Paulo (1980; data added to an already completed manuscript).

METHODS

Methods are as explained in KULLANDER (1979a, 1980a, b) unless otherwise stated. Abbreviations include BMNH (British Museum (Natural History)), CAS (California Academy of Sciences), CM (Carnegie Museum), CP (caudal peduncle), FMNH (Field Museum of Natural History), IUM (Indiana University Museum), MHNG (Muséum d'Histoire naturelle de Genève), MZUSP (Museu de Zoologia da Universidade de São Paulo), NRM (Swedish Museum of Natural History), SL (standard length).

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Apistogramma commbrae (Regan, 1906) (Fig. 1, 2)

SPECIES BIBLIOGRAPHY

Mesops taeniatus (non Günther); (pt) BOULENGER 1895, p. 1 (brief descr. including also *A. borellii* (Regan) and *A. trifasciata* (Eigenmann & Kennedy); Colonia Risso [BMNH 1895.1.30: 6-9]); BOULENGER 1900, p. 1 (name only; [Carandasiño; BMNH 1900.4.14: 16]; including also *A. borellii*).

Biotodoma taeniatum (non *Mesops taeniatus* Günther); (pt) PELLEGRIN 1904, p. 187 (ref. to BOULENGER (1895) only).

Heterogramma commbrae REGAN 1906a, p. 61 (in key), p. 64 (protologue; descr., bibliogr., distr., no types designated; [C.H.] Eigenmann credited as author of name; Carandasiño, Matto Grosso [BMNH 1900.4.14: 16]; Colonia Risso [BMNH 1895.1.30: 6-9]), p. 65 (comp. with *A. trifasciata*).

Heterogramma commbae [REGAN] 1906b, p. viii (unjustified emendation of spelling of *commbrae* in REGAN (1906a)); IHERING 1907, p. 322 (in key), p. 324 (notes based on REGAN (1906a); bibliogr.), p. 324 (close ally of *A. trifasciata*).

Heterogramma corumbae Eigenmann & Ward, in EIGENMANN *et al.* 1907, p. 146 (protologue; descr., diagnostics; Corumba, IUM 10166 [now CAS 33719] type, IUM 10167 [pt. now CAS 33720] cotypes; near Puerto Max, specimens), p. 155 (distr.), pl. XLV, fig. 3 (monochrome photo of type, habitus, lateral aspect); REGAN 1909, p. 270

(note on anal spine number; allied to *H. pleurotaenia* Regan); EIGENMANN 1909, p. 347 (distr.); EIGENMANN 1910, p. 478 (distr.); (pt) HASEMAN 1911, p. 359 (brief descr., including also undescribed species; Corumba, Rio Paraguay [FMNH 54179]; Villa Hays, Paraguay [FMNH 54180]), pp. 358, 359 (comp. with *H. taeniatum* (Günther)), p. 360 (comp. with *H. ortmanni* *nom. nud.*), pl. LXVII (monochrome retouched habitus photo, lateral aspect, [FMNH 54180]); HASEMAN 1912, pp. 64, 66 (distr.); EIGENMANN 1912, p. 507 (comp. with *H. ortmanni* Eigenmann); BERTONI 1914, p. 15 (name); RIBEIRO [1915], p. 46 (in key), p. 48 (descr., from REGAN (1906a)); FOWLER 1932, p. 373 (descr.;

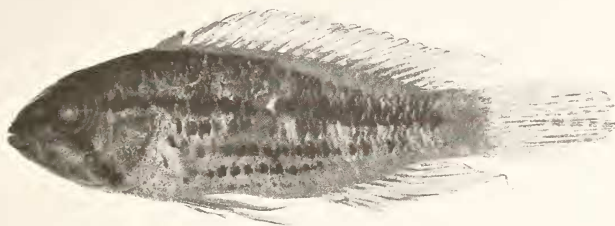


FIG. 1.

Apistogramma commbrae (Regan). NRM A80-3002, a male, 26.5 mm SL, from Puerto Max, Paraguay

Descalvados [ANSP 53913-53915], fig. p. 374 (habitus sketch, lateral aspect);? MEINKEN 1937, p. 80 (brief descr.; mittleren Paraná); BERTONI 1939, p. 58 (name).

Apistogramma corumbae; REGAN 1913, p. 282 (name; distr.); AHL 1931, p. 211 (related to *A. parva* Ahl); PEARSON 1937, p. 112 (distr.); POZZI 1945, pp. 266, 277 (distr.); RINGUELET *et al.* 1967, p. 499 (in key), p. 500 (descr., copied); TERRAZAS 1970, p. 35 (distr.); LANGHAMMER 1975, p. 13 (note on name);? BONETTO *et al.* 1978, Tab. I (listed; cuenca del Riachuelo).

Heterogramma corumbae RIBEIRO 1918, p. 24 (name), p. 132 (bibliogr.; unjustified emendation of spelling of *commbrae* in REGAN (1906a)).

Apistogramma Corumbae; PELLEGRIN 1936, p. 46 (name).

Apistogramma commbrae; FOWLER 1954, p. 275 (bibliogr.), Fig. 863 (from FOWLER (1932));? WICKLER 1960, p. 328 (egg morphology); (pt) MEINKEN 1961a, p. 135 (distr.; not Peruvian material, p. 139, = probably *A. cacatoides* Hoedeman);

MEINKEN 1961*b*, p. 169 (relationships); MEINKEN 1962, p. 141 (in key-like list); MEINKEN 1969, p. 166 (distr.); (pt) MÜLLER & WEIMER 1976, pp. 111, 119 (distr.; not Amazonas); GOSSE 1976, p. 23 (name); KULLANDER 1979*a*, p. 73 (senior syn. of *A. corumbae*; Colombian records incorrect); KULLANDER 1980*a*, pp. 7, 9, 11, 24, 25, 27, 29, 49, 70, Tabs. 1, 2 (various notes on distr., synonymy, etc.).

Apistogramma combrae; (error in spelling) MEINKEN 1960, p. 657 (comp. with *A. wickleri* Meinken).

SYNONYMY

Heterogramma commbrae Regan, 1906

Heterogramma commbae Regan, 1906

Heterogramma corumbae Eigenmann & Ward in Eigenmann et al., 1907

Heterogramma corumbae Ribeiro, 1918

LECTOTYPE

By present designation: BMNH 1900.4.14:16. ♀, 27.3 mm SL Carandasiñho, Matto Grosso [Brazil, Estado do Mato Grosso, Carandaziñho], leg. A. Borelli, date not recorded.

DIAGNOSIS (REVISED)

Length of head 31.0-36.2% of SL; body depth 32.8-38.0% of SL. CP length 74.9-105.9% of CP depth. D. XV.7, XVI.5-6.i, XVII.5-6. A. III.5-7, IV.4.i-6. Squ. long. 21-22. Rakers 1-4. Preoperculum entire. Dorsal fin without produced lappets. Caudal fin rounded. No lateral spot or chest blotch. Bars and pectoral spot present; lateral band and three to four abdominal stripes distinct; Bar 7 expanded, confluent with caudal spot. Dorsal fin dark anteriorly; caudal fin striped. Distinguished from all other species in the genus by the combination of colour pattern and meristics. *Apistogramma nijsseni* Kullander, and an undescribed Paraguayan species with similar tail spot, lack abdominal stripes, and the latter also has a modal number of 15 rather than 16 dorsal spines. (Based on lectotype and Paraguayan material described below, except for D and A counts which include complementary material; of both sexes, 24.2-32.6 mm SL.)

DESCRIPTION

Material. A complete list of the material used in the description is given at the end of the paper. The description is based primarily on a large male, MHNG 2027. 73-74, 32.6 mm SL. Quantitative data are from the BMNH, MHNG, MZUSP and NRM specimens, unless otherwise stated (see also Table 1). The older material, studied in 1975, was examined for but a limited data set; since it is also in a not very useful condition, only the more interesting counts are given below. All specimens are preserved in ethanol and, except for the MHNG, MZUSP, and NRM material, in rather poor condition.

Morphology. Body moderately elongate, deepest and broadest just behind gill cover. Dorsal contour slightly ascending or about straight horizontal to about 7th dorsal spine, caudally straight descending, continuous with predorsal contour; a sharp

TABLE 1.

Morphometry of Apistogramma commbrae. Combined data from BMNH 1900.4.14:16 (lectotype), MHNG 2027.73-76, NRM A80-3002, and MZUSP unreg. (Itiquira, Mato Grosso, 24-29 Oct. 1978; Corumbá, Mato Grosso, 13 Oct. 1977). Standard length and lectotype data in mm, others in per cent of standard length, except CP/CP (CP length as per cent of CP depth).

Measurement	Range	$\bar{x} \pm s_x$	n	Lectotype
Standard length	16.3- 32.6		10	27.3
Head length	31.0- 36.2	32.7 \pm 0.54	10	9.1
Head depth	25.3- 28.6	27.4 \pm 0.33	10	7.7
Body depth	32.8- 38.0	35.2 \pm 0.48	10	9.7
Predorsal length	33.8- 40.5	36.7 \pm 0.64	10	9.7
Preventral length	36.4- 43.6	39.5 \pm 0.66	10	10.5
Orbit diameter	11.3- 15.3	12.7 \pm 0.43	10	3.2
Snout length	5.0- 6.6	5.9 \pm 0.17	10	1.4
Cheek depth	6.1- 7.3	6.7 \pm 0.15	10	1.8
Head width	16.6- 19.9	17.6 \pm 0.38	10	4.7
Interorbital width	7.4- 9.2	8.1 \pm 0.20	10	2.2
Preorbital depth	2.5- 3.1	2.8 \pm 0.08	10	0.8
Upper jaw length	8.6- 11.0	9.9 \pm 0.22	10	2.7
Lower jaw length	12.7- 14.4	13.6 \pm 0.22	10	3.8
Postorbital head length	13.2- 16.0	14.1 \pm 0.33	10	3.7
CP depth	14.3- 16.6	15.1 \pm 0.21	10	4.2
CP length	12.3- 15.7	13.2 \pm 0.36	10	3.4
Dorsal base length	56.8- 60.9	58.8 \pm 0.44	10	16.4
Anal base length	17.2- 23.5	20.5 \pm 0.55	10	5.5
Pectoral fin length	26.6- 30.8	28.9 \pm 0.48	9	8.0
Ventral spine length	12.6- 15.2	14.2 \pm 0.30	9	4.1
Ventral fin length	25.9- 36.4	30.9 \pm 1.33	9	7.8
Last D spine length	16.1- 18.5	17.3 \pm 0.28	9	4.4
Third A spine length	16.3- 20.2	18.2 \pm 0.46	10	5.2
CP/CP	74.1-105.9	87.2 \pm 2.82	10	—

break with dorsal caudal peduncle contour, which straight, horizontal. Chest contour straight, sloping; abdominal contour about straight; anal base contour cranially slightly concave, caudally slightly convex, sloping dorsad and more or less continuous with straight sloping caudal peduncle contour. Head moderately elongate, longer than deep, slightly shorter than body depth. Predorsal contour straight ascending to about three-fourths of orbit, caudally gradually levelled, angle of slope about 33-36° (40°); preventral contour slightly convex, sloping at about 27-32°. Snout short, rounded; contour slightly curved, dorsal slightly steeper; in female much more decurved than in the others. Angle of maxilla about 58°; tip exposed, reaching to slightly beyond vertical from anterior margin of orbit. Lower jaw distinctly longer than upper, but equal anteriorly. Orbit diameter 35.2-43.1%, $\bar{x} = 38.9 \pm 0.80\%$ of head length (n=10, including lectotype); situated chiefly in dorsal and rostral halves of head; subtangential. Preoperculum entire in all specimens examined.

Depth of exposed part of body scales greatest anteriorly on flanks, lesser toward flank margins; about halved on caudal peduncle. Squ. long. 21 (1), 22 (9, including lectotype). Predorsal scales cycloid, ventrally to anteriorwards curved line between dorsal fin origin and dorsal tip of preoperculum; squ. prd. 9 (3), 10 (5), 11 (2). Chest scaling rostrally variously developed; squ. prv. 6 (1), 8 (2), 9 (5). The throat may be naked anterior to or at region of ventral tip of cleithrum. Cheek scales small, cycloid, in 3 (6) or 4 (4) series; naked rostroventral portion of varying size. Opercular scales 8 (1), 9 (3), 12 (2), 13 (1), dorsally ctenoid, gill-cover scales otherwise cycloid. Subopercular scales 3 (2), 4 (4), 5 (1), 5+1 (1), rarely in two series in complementary material. Squ.

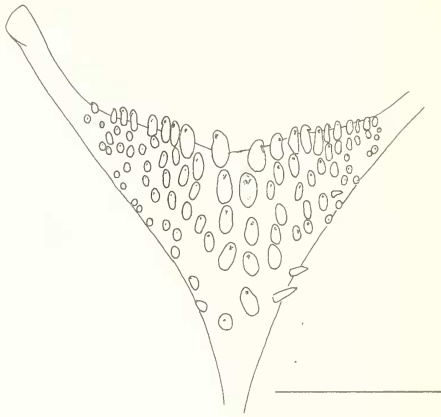


FIG. 2.

Lower pharyngeal tooth-plate of *Apistogramma commbrae*.
Occlusal view; scale 1 mm; from MHNG 2027.73-74, 30.2 mm SL.

iop. 1 (1), 2 (6), 3 (2). Lateral lines with 5 (1), 6 (1), 8 (2), 9 (2), 10 (2), 11 (1) canals, 13 (1), 14 (6), 15 (2) canals + pores. One to four subserial pores in 7 of 10 upper lateral lines (MHNG + NRM material). None (9) or 2 (1) canals, total 6 (3), 7 (3), 8 (2), 9 (2) scales in lower lateral line, which not continued on caudal fin. One or two lower lateral line canals in FMNH material and holotype of *A. corumbae* (Eigenmann & Ward); otherwise only pores in the lower line in the supplementary material. Upper line extending by pores to about below penultimate dorsal spine; lower to about third anal ray. Dorsal and anal fins naked; proximal one-fourth of caudal fin covered by mostly ctenoid scales; squ. caud. 3 (1), 4 (5), 5 (2).

Dorsal spines increasing in length to about fifth, from which subequal, the last longest. Lappets rounded or subtruncate, none produced. Soft part pointed, second ray slightly produced, reaching to almost middle of caudal fin; in other males pointed, not quite to middle of caudal fin; in female rounded, to one-fourth of caudal fin. Soft

anal fin similar, but not produced, reaching to less than one-third of caudal fin; similar to soft dorsal in the others.

D. (n=33) XV.7 (1), XVI.— (1), XVI.5 (3), XVI.5 (3), XVI.5.i (2), XVI.6 (21), XVI.6.i (2), XVII.5 (2), XVII.6 (1). A. (n=34) III.— (1), III. 5 (3), III.5.i (3), III.6 (16), III.6.i (2), III.7 (4), IV.4.i (1), IV.5 (3), IV.6 (1). In the holotype of *A. corumbae* (Eigenmann & Ward), two spines or rays in the transitional part of the dorsal fin are broken; although the remains appear rather like spines, EIGENMANN *et al.* (1907) give the count D.XVI.6 rather than the alternative XVIII.4. I count XVI. (2 broken).4.i. EIGENMANN *et al.*'s count is more in accordance with counts from other specimens, and on their photo (pl. XLV), the dorsal fin appears not to be damaged. However, I have excluded this uncertain count from the enumeration above.

Pectoral fin rounded; fifth ray longest; reaching to vertical from about genital papilla. P. 11 (3), 12 (7). Ventral fin pointed; outermost ray slightly produced, inner rays gradually shorter, reaching about end of spinous anal fin in males; not produced, to anal fin origin in females. Caudal fin rounded, dorsal lobe slightly longer than ventral; marginal rays simple, inner with two to four branches; 16 principal rays in all specimens examined.

Teeth pointed, conical, slightly or not recurved. No conspicuous size difference between outer and inner teeth. In upper jaw anteriorly three (or four) series, in lower jaw three or four series. In outer series of upper/lower jaw on one side in the smallest to largest MHNG + NRM specimens: 14/—; c.16/c.20; 18/22; 20/22; 19/18 (\bar{x} = c. 17.4/20.5). Vertebral counts 12 + 12 (2) or 12 + 13 (3). One supraneural. Lower pharyngeal tooth plate and dentition as shown in Fig. 2; lateral rakers 8 (4), 9 (4), 10 (1). Gill-rakers on first ceratobranchial 1 (1), 2 (4), 3 (4), 4 (1).

Coloration. (From the fresh MHNG + NRM material.) Ground colour whitish with a faint touch of yellowish. Chest, throat and abdomen dirty white to pure ground colour. Markings on body dark brown, on fins blackish, unless otherwise stated.

Sex dichromatism slight. Female paler ventrally, with weaker caudal fin pigmentation, a weak, narrow short midventral stripe forwards from vent. The abdominal stripe originating from between the pectoral axilla and the ventral fin base is absent. Both sexes have dark-edged ventral fins.

Vertical bars pale greyish brown; Bars 1 to 6 darkened near dorsal base, indistinctly continued into dorsal fin; supraopercular bar above upper lateral line confluent with the one succeeding; Bar 2 extending ventrad to lateral band; Bars 3-5 to horizontal scale series below lateral band; Bar 6 traced to anal base termination; all rather straight, wider than interspaces. Bar 7 appears as an irregularly shaped, brownish blotch over most of the side of the caudal peduncle, confluent with the caudal spot. This tail-marking is not evident in the older material studied, although shown on EIGENMANN *et al.*'s figure of the holotype of *A. corumbae* (1907, pl. XLV, fig. 3).

No lateral spot or any other flank spot. A narrow lateral band, about one scale deep, rather evenly pigmented, ignorably or not intensified where crossing vertical bars, to Bar 7. Postorbital stripe moderately wide, narrower than pupil; suborbital stripe to margin of gill-cover at junction of sub- and interopercularia, of pupil width or narrower; superorbital stripe to about midline of nape, near orbit of about pupil width, dorsally narrower and fainter. Preorbital stripe narrower than pupil. Snout, lips, cheek, ventral parts of head grey to greyish whitish, ventrally paler, forehead greyish. Dorsal pectoral spot, not extending onto medial side of pectoral axilla. No distinct dark spot on chin.

Abdominal stripes very prominent, as intensely pigmented as lateral band or feebly fainter; made up of roundish or rectangular spots on scale centers. The dorsalmost from dorsal edge of pectoral axilla to Bar 3; another from under pectoral axilla to

Bar 6, most distinct in the bars; a third similarly but from the lower edge of the pectoral axilla; a fourth from just behind a vertical from pectoral axilla base to Bar 4 or 5 in males only.

Dorsal fin smoky; anterior two spines and membranes black; no edge markings; dark spot on base of each membrane excepting four anterior; about two or three colourless spots on each of about three terminal membranes form terminal spot-stripes. Anal fin similar in ground-colour but outer edge faintly darker; membrane bases as in dorsal fin; about one to two terminal spot-stripes. Caudal fin distally slightly smoky; about six vertical stripes of pale spots, particularly vivid on middle portion, somewhat irregular (may also be perceived as dark striping). Caudal spot black, squarish, confluent with Bar 7; above and below pale (round pale spots appearing). Ventral fin almost colourless except outwards along margin where greyish to black.

DISTRIBUTION

The range of *A. commbrae* extends along the Rio Paraguay, from the Asunción area, or even as far south as Corrientes (cf. MEINKEN 1937, BONETTO *et al.* 1978), to Brazilian headwaters (rivers Piquiri, Cuiabá, and Paraguai to Cáceres).

REMARKS

Nomenclature. Some confusion exists concerning the scientific name of the species here called *Apistogramma commbrae*, as should be apparent from the bibliography. The alternative *A. corumbae* has been preferred by some authors, for varying reasons.

LANGHAMMER (1975) suggested "that all use of the name *Apistogramma commbrae* be terminated" in favor of *A. corumbae*, arguing that the species epithet was misspelled by Regan. VIERKE (in REITZIG 1977), referring to the International Code of Zoological Nomenclature (henceforth abbreviated to ICZN), concluded that the spelling *commbrae* was to be maintained even if it be a misspelling. Myself (KULLANDER 1980a), I have indicated that I consider "*A. commbrae* (Eigenmann in Regan, 1906)" (but cf. below as regards authorship) a senior synonym of *A. commbae* (Regan) and *A. corumbae* (Eigenmann & Ward). All names were thus accepted as available, and synonymization followed from examination of relevant type-material. Below, I will give an augmented explanation of my view as regards the valid name, referring to the ICZN for guidelines in decisions.

REGAN (1906a) published the first description of *Heterogramma commbrae*, listing one specimen from Carandasiñho, Matto Grosso, and four specimens from Colonia Risso, as material. In the bibliography is cited BOULENGER'S (1895) description of *Mesops taeniatus* (part.; referring to the Colonia Risso material; Regan refers to "p. 33", but a copy of BOULENGER'S paper available is paginated 2 through 3, the first page not numbered but representing page 1 and featuring the *M. taeniatus* description), and "*Biotodoma commbrae*, Eigenm., M. S.". The last reference is explained in a footnote: "— [Prof. Eigenmann] sent me photographs of the three Paraguayan species of this genus, viz. *H. Borellii* (named by him *B. taeniatum*), *H. trifasciatum*, and the present species, named *B. commbrae*, which I had intended describing under another name. I have kept back this paper in the hope that his memoir containing the descriptions of these species might be published; but this not having occurred, I have taken his name for this species, which should be called *H. commbrae*, Eigenm."

The description satisfies all conditions for making the name available according to the ICZN. The name *commbrae* appears four times on p. 64, once on p. 61 (key)

and once on p. 65 (comparison with *H. trifasciatum*). There is no indication of a slip of the pen or a typographical error. Regan usually did not explain the etymology of his names, and made no exception in the case of *commbrae*.

On the reprints of Regan's paper and in the index to the very volume (but not in the issue) of the *Annals and Magazine of Natural History* (REGAN 1906b), is printed a correction: "ERRATUM". ["ERRATA" on reprints.] "Pages 61, 64, 65, for *Heterogramma commbrae* read *Heterogramma commbae*." This correction should be recognized only as a junior objective synonym of *H. commbrae*, following ICZN Art. 32(a): "The original spelling of a name is to be retained as the 'correct original spelling', unless" "(ii) there is in the original publication itself, without recourse to any external source of information, clear evidence of an inadvertent error, such as a lapsus calami, or a copyist's or printer's error (incorrect transliteration, improper latinization, and use of an inappropriate connecting vowel are not to be considered inadvertent errors)...", and 33 (a) (ii): "Any other emendation..." (than a "justified emendation", a correction of an incorrect original spelling) "... is an 'unjustified emendation'; the name thus emended has status in nomenclature with its own date and author, and is a junior objective synonym of the name in its original form."

No evidence to be found that Eigenmann was involved in the conditions that make *commbrae* available, I conclude that Regan is the author of the name *Heterogramma commbrae*. Article 50 of the ICZN states: "The author (authors) of a scientific name is (are) the person (persons) who first publish(es) it [III] in a way that satisfies the criteria of availability [IV], unless it is clear from the contents of the publication that only one (or some) of the joint authors, or some other person (or persons) is alone responsible both for the name and the conditions that make it available." (My italics.) The crucial persons of the last part of the article are two, so it seems it would not apply, and that Regan is the author of the name. The only exception allowed in the code is presented in Art. 50 (a) and applies only to names published in the minutes of a meeting.

Eigenmann & Ward (in EIGENMANN *et al.* 1907) published the description of *Heterogramma corumbae*, based on a "type" from Corumba, nine "cotypes" from Corumba, and two "specimens" from near Puerto Max. Having evidently seen REGAN's paper (1906a), in which the name *Heterogramma* was first published, they nonetheless avoided every reference to Regan's *H. commbrae* and *H. commbae*. It appears, however, to be quite justified to assume that *corumbae* was the name that Eigenmann once communicated to Regan, who somehow got it wrong. It is less likely that Eigenmann actually wrote *commbrae* (or *commbae*), unintentionally spelling the name of the locality wrongly. There being no evidence in EIGENMANN *et al.* (1907) that *corumbae* is an error for or emendation of *commbrae* or *commbae*, *H. corumbae* must be regarded as a distinct nominal species. It may be noted here also that in the list of "Errata" for EIGENMANN *et al.* (1907), a *nomen nudum*, *Biotodoma fasciatus*, is corrected to *Heterogramma borellii*, but *H. corumbae* is not corrected.

Only VON IHERING (1907) and RIBEIRO (1918) have observed the name *commbae*. RIBEIRO's citation "*Heterogramma corumbae* Regan — An. & Mag. Nat. Hist. vol. XVII — 1906" (p. 24), and his bibliography (p. 132) must be considered as an unjustified emendation of Regan's spelling of the name. It is clear from the bibliography that RIBEIRO was aware of all names published up till then (*commbrae*; *commbae* [misspelled *combae*]; *corumbae*), and that although he cites (p. 132) the first description as "*Heterogramma combae*, Regan, Annals & Mag. Nat. Hist., Ser 7^a, vol. XVII, pg. 64 — 1906", he refers to the species as *H. corumbae*. Article 33 (a) (ii) of the ICZN again applies. In RIBEIRO (1915), the use of "*H. corumbae*, Regan" is not clearly an error, but may be interpreted as a mistaken combination of species and author names.

From the foregoing, I conclude that there are four nominal species with type-series as follows:

1. *Heterogramma commbrae* Regan, 1906 (five syntypes, from Carandazinho and Colonia Risso)
2. *Heterogramma commbae* Regan, 1906 (same type-series as *H. commbrae*)
3. *Heterogramma corumbae* Eigenmann & Ward in EIGENMANN *et al.*, 1907 (holotype from Corumbá; nine paratypes from Corumbá; two "specimens" from near Puerto Max)
4. *Heterogramma corumbae* Ribeiro, 1918 (same type-series as *H. commbrae*).

The oldest name should be considered valid, if the *H. commbrae* and *H. corumbae* type-materials are conspecific. Their identity in this regard has never been doubted, however. Synonymy is indicated already in EIGENMANN'S (1910) and REGAN'S (1913) use of the name *corumbae* only, and is more expressly considered by e.g. FOWLER (1954), who, however, preferred "*Apistogramma commbrae* (Eigenmann [in Regan])". MEINKEN (in HOLLY *et al.*) also preferred *commbrae* and treated *corumbae* as a junior synonym, explaining the etymology of *commbrae* as "ein Lesefehler Regans anlässlich einer schriftlichen Mitteilung Eigenmanns und Regan, sollte offenbar heissen — *corumbae*...".

Lectotype. Regan's specimen from Carandazinho is proposed as lectotype of *Heterogramma corumbae*. It bears the data "B.M. (N.H.) No. 1900-4-14:16. Syntype. Carandasiñho, Matto Grosso, Borelli". Measurements are given in Table 1. It is probably a female. The general colour is rather dark. The fins are a uniform yellowish brown. Horizontal stripes are indicated in the form of a lateral band and three abdominal stripes. There are four lectotypes, BMNH 1895.1.30:6-9, from Colonia Risso, leg. A. Borelli, standard lengths 18.0, 19.0, 22.7, and 26.7 mm. Counts from these specimens are included in the description above.

Type-series of *A. corumbae* (Eigenmann & Ward). The holotype of *A. corumbae* (CAS 33719), a 22.7 mm SL specimen from Corumbá, has undergone quite some change since it was photographed (EIGENMANN *et al.* 1907, pl. 45, fig. 3). It is in bad shape and has lost most of the coloration, but traces of abdominal stripes can be seen. One of the paratypes (CAS 33720, five specimens), has A. IV.4.i, another D. XVII.5, although the authors give D. XVI.6, A. III.6-7. Meristic data from this type-series is used in the description above. The fate of the remaining paratypes and the Puerto Max specimens is unknown. There is nothing, as far as I can see, that would suggest distinctness of any part of the material here considered to represent only one species, *A. commbrae*, although the poor condition of all old specimens potentially secludes important characters. Then, though, Regan's and Eigenmann & Ward's descriptions are useful.

Relationships. REGAN (1906a) compared *A. commbrae* with *A. trifasciata* (Eigenmann & Kennedy), and these two species are also placed together in his key to the then five species of the genus. *Apistogramma trifasciata* has a very different colour pattern, including a dark stripe running obliquely across the abdominal sides. Probably, *A. commbrae* should rather be associated with the *regani* group species, with which it has in common the lack of a lateral spot, a modest finnage, lateral band, etc., although this is not a well defined group (KULLANDER 1980a). A prominent feature distinguishing *A. commbrae* from the other *regani* group species is above all the few or absent lower lateral line canals. As this seems to be a characteristic rather of Paraguayan species,

it appears more appropriate to consider it a character subject to latitudinal variation or otherwise correlated with geographical distribution (cf. KULLANDER 1980a).

The *commbrae* group (Kullander 1980a) may thus be united with the *regani* group, in connection with the removal of *A. luelingi* Kullander, which should be associated with *A. cacatuoides* Hoedeman (KULLANDER, in prep.). Other *regani* group species, viz. *A. regani* Kullander, *A. ortmanni* (Eigenmann), and *A. taeniata* (Günther), share with *A. commbrae* the conspicuous abdominal stripes. This is not likely a character state indicating close phyletic relationship, since it occurs also in *A. cacatuoides*, *A. luelingi*, and *macmasteri* group species, and there may be more justification in considering an undescribed species (in prep.) from the upper Paraguay system, as the closest relative of *A. commbrae*. Although it lacks abdominal stripes, it has the same tail spot, formed by the intense last body bar confluent with the caudal spot. This form differs from *A. commbrae* also in having only 15 dorsal spines.

Apistogramma pleurotaenia (Regan) is known from two females, 27.6 (holotype, BMNH 1909.2.25:61) and 25.9 mm SL (specimen, BMNH 1909.4.2:37), both with four anal spines. These are labelled "La Plata", and thus possibly from the Paraguay system, less credibly from the city La Plata in Argentina. Lacking abdominal stripes and tail spot, they should probably not be associated with *A. commbrae*, although the high anal count would suggest just that. Living specimens said to have been determined by Regan (MEINKEN 1961b), figured by e.g. HOLLY *et al.*, appear clearly different in shape, development of finnage and color pattern. HASEMAN (1911) synonymized *A. pleurotaenia* with *A. borellii*, but these species are clearly distinct (cf. below), and all of Haseman's *A. borellii* appear to be correctly identified with that name (cf. KULLANDER 1980a).

There are three, maybe only one more *Apistogramma* species known from the Paraguay system, viz. *A. borellii* (Regan), and the probably synonymous *A. rondoni* (Ribeiro), and *A. aequipinnis* Ahl. At least *A. borellii* is clearly sex dimorphic, and lacks gill-rakers on the first ceratobranchial as well as postorbital stripe. Characteristically, the lateral band is restricted to the rear part of the side (KULLANDER 1980a). When synonymizing *A. reitzigi* Ahl (1939) with *A. borellii* (KULLANDER 1980a), I was unaware of a preliminary description of *A. reitzigi* in MITSCH (1938). That description satisfies the criteria for availability of the name although it is quite brief. The name is credited to Ahl, and is published in a journal edited by him. No type is designated, and no preserved material in particular mentioned, so conspecificity of the specimen later described in a formal context (AHL 1939) as *A. reitzigi*, with *A. borellii*, cannot be used as an argument for identity of *A. reitzigi* with *A. borellii*. It is probable, however, that both descriptions are based on the same material, because the earlier one is apparently an abstract of the later one. Thus, although there is no formal type-designation in MITSCH (1938) and no specific reference to study material, the specimen described by AHL (1939) may be referred to in questions regarding taxonomic status of *A. reitzigi*. The discovery of an earlier description thus affects merely the date of publication of the name *A. reitzigi*.

Anal spines. Of the *A. commbrae* examined, about 15% have four anal spines (5 of 34), the remainder three, which is the almost exclusive count in the genus (with about 50 species). The two specimens known of *A. pleurotaenia* have four anal spines; this material is insufficient, however, because four anal spines are occasionally found in three-spined species (KULLANDER 1980a). The only other *Apistogramma* species in which a count of four anal spines is commonly encountered is *A. luelingi* in the Bolivian Amazonas drainage (KULLANDER 1976). With a lateral spot, and many scales on operculum (generally more than 10) and suboperculum (two series, generally more

than five scales), it is clearly distinguished from *A. commbrae*. Further, while four anal spines occurs frequently in *A. commbrae*, only one out of 20 specimens examined of *A. luelingi* has three instead of four anal spines (including unreported material from the Rio Manú, Perú). Although there appears to be no close phyletic relationship between these species, it may be noted that their geographical ranges are adjacent, and that with *Apistogrammoides pucallpaensis* Meinken in the Peruvian Amazonas drainage, all *Apistogramma* and *Apistogramma*-like cichlids with regularly or normally more than three anal spines are found in the west and southwest of the range of the genus. *Apistogrammoides pucallpaensis* is placed in a separate genus chiefly for reason of its many (7-9) anal spines (cf. KULLANDER 1980a).

I have previously (KULLANDER 1976) preferred to consider three anal spines as the "normal or plesiomorph" number in *Apistogramma*. That is in agreement with the view held by REGAN (1906c), who consistently considered the three-spined American cichlids as the more ancestral compared to those with more than three anal spines (four to 12). Actually, there seems to be nothing besides relative frequency to support such an opinion.

The value of the anal spine number as a generic character was criticized already by BOULENGER (1916), following a study of East African species of the genus *Sarotherodon* Rüppell, but the system of both the American and the African Cichlidae is still to a great extent characterized by the distinction between the three-spined and the polyacanth condition, much as in Regan's revisions (cf. e.g. REGAN 1906c). In African cichlids, the genus *Sarotherodon* presents a situation possibly analogous to that in *Apistogramma*. *Sarotherodon* species have normally three anal spines, but four, five or six spines are commonly encountered in the *S. mossambicus* (Peters) species group in East Africa; in five species four spines is the normal count (WHITEHEAD 1962). GREENWOOD (1979) regarded the increased number of anal and dorsal fin spines in the African genus *Astatoreochromis* Pellegrin, as derived character states, and one of the rationales for maintenance of the genus, including three species, one with four to six, another with three or four, and a third with only three anal spines. Thus, examples from both African and American genera speak against the view that there is a natural break of generic significance in anal spine number.

MATERIAL

BMNH 1900.4.14:16, ♀, 27.3 mm SL. Brasil, Est. Mato Grosso, Carandazinho. No date. Leg. A. Borellii. (Lectotype of *A. commbrae*.) — MHNG 2027.73-74, 2 ♂♂, 30.2 and 32.6 mm SL. Paraguay, Depto. Concepción, between Estancia Estrellas and Estancia Primavera, (temporary?) swamp in connection with Riacho La Paz. 16 October 1979. Leg. Zoological Expedition of the Muséum d'Histoire naturelle de Genève to Paraguay, 1979. — MHNG 2027.75-76, NRM A80-3002, 2 ♂♂, 26.5 and 29.2 mm SL, ♀, 24.2 mm SL. Paraguay, Depto. Concepción, Puerto Max, Estancia El Postillón, small affluent of Arroyo León. 19 October 1979. Leg. as preceding. — MZUSP unreg., ♂, 29.4 mm SL. Brasil, Est. Mato Grosso, Itiquira, Fazenda Sto. Antonio, internal lakes of the Piquiri-Itiquira system. 24-29 October 1978. Leg. J. C. de Oliveira. (Measurements and counts only.) — MZUSP unreg., 2 ♀♀, 20.6 and 22.9 mm SL, juv., 16.3 mm SL. Brasil, Est. Mato Grosso, mun. Corumbá, fifth bridge after the R. Miranda (Sul). 13 October 1977. Leg. CEPIPAM. (Measurements and counts only.)

Complementary material. ANSP 53913-53914, 3 specimens, 18.0-20.5 mm SL. Brasil, Est. Mato Grosso, Descalvados. September 1931. Leg. J.A.G. Rehn. —

BMNH 1895.1.30:6-9, 4 specimens, 18.1-26.7 mm SL. Paraguay, Depto. Concepción, R. Paraguay, Colonia Risso. No date. Leg. A. Borelli. (Paralectotypes of *A. commbrae*.) — BMNH 1935.6.4:466-469, 4 specimens, not measured. Paraguay, "Near Asunción". No date. Leg. Schouten. — CAS 33719 (IUM 10166), 1 specimen, 22.7 mm SL. Brasil, Est. Mato Grosso, Corumbá. No date. Leg. J. D. Anisits. (Holotype of *H. corumbae* Eigenmann & Ward.) — CAS 33720 (ex IUM 10167), 5 specimens, 16.8-27.0 mm SL. Brasil, Est. Mato Grosso, Corumbá, R. Paraguai. No date. Leg. J. D. Anisits. (Paratypes of *H. corumbae* Eigenmann & Ward.) — FMNH 54179 (CM 2753), 1 specimen, 29.2 mm SL. Brasil, Est. Mato Grosso, Corumbá, R. Paraguai. 9 May 1909. Leg. J. D. Haseman. — FMNH 54180 (CM 2754), 1 specimen, 21.6 mm SL. Paraguay, Depto. Presidente Hayes, Villa Hayes. 13 April 1909. Leg. J. D. Haseman. — MZUSP 4464 (pt), 2 specimens, 12.7-25.8 mm SL. Brasil, Est. Mato Grosso, Santo Antonio do Leverger, lagoa. 1965. Leg. G. Olson. — MZUSP unreg., 1 specimen, 22.7 mm SL. Brasil, Est. Mato Grosso, Cáceres, R. Paraguai, beaches. 13 August 1980. Leg. R. M. Corrêa e Castro (MZUSP coll. no. 801146). — MZUSP unreg., 1 specimen, 26.4 mm SL. Brasil, Est. Mato Grosso, Ilha de Taiaimã, bay. 8 August 1980. Leg. R. M. Corrêa e Castro (MZUSP coll. no. 801114). — MZUSP unreg., 5 specimens, 17.6-25.1 mm SL. Brasil, Est. Mato Grosso, Descalvados, R. Paraguai, beaches. 9 August 1980. Leg. R. M. Corrêa e Castro (MZUSP coll. no. 801132).

SUMMARY

Careful examination of the literature, and comparison of type-materials show that an *Apistogramma* species in the Paraguay river system was named four times: as *Heterogramma commbrae* Regan (1906a), *H. commbrae* Regan (1906b), *H. corumbae* Eigenmann & Ward (in EIGENMANN *et al.* 1907), and *H. corumbae* Ribeiro (1918). With reference to the International Code of Zoological Nomenclature, I conclude that the species should be called *Apistogramma commbrae* Regan (1906a), despite that Regan credited Eigenmann as author, and that the name is apparently a misspelling of *corumbae*. The largest of the 34 specimens examined is 32.6 mm SL. The distribution is restricted to the Paraguay river system, from Cáceres on the Rio Paraguay in the north, to near Asunción in the south. Distinctive characters are a caudal peduncle spot confluent with the caudal base spot, abdominal stripes and a high number of dorsal spines (15-17, mode 16), and reduced number of lower lateral line canals. Five of 34 specimens have four anal spines.

Apistogramma commbrae belongs to the *regani* species group. The recognizal of a *commbrae* group (KULLANDER 1980a) is apparently unwarranted. Like in other Paraguayan species of the genus, the lower lateral line contains only few (one or two), or usually, no canals; a character distinguishing *A. commbrae* from other *regani* group species, but probably correlated to distribution. *Apistogramma luelingi*, once included in the *commbrae* group, differs in having a lateral spot and more gill-cover scales; it should be associated with *A. cacatuoides*. An undescribed species in the upper Paraguay river system has a tail spot like *A. commbrae* and may be the most closely related species. It differs in lacking abdominal stripes and in a lower dorsal fin spine count (mode 15).

Apistogramma pleurotaenia is also distinguished by the lack of abdominal stripes. Distinguishing characters of *A. borellii* are pronounced sex dimorphism, lack of first ceratobranchial gill-rakers, lack of postorbital stripe, and reduced lateral band. A preliminary description of a junior synonym of *A. borellii*, viz. *A. reitzigi*, is found in

MITSCHE (1938). This species should be referred to as *A. reitzigi* Ahl, 1938 (in MITSCHE), although a formal description did not appear until the following year (AHL 1939).

The high frequency of four anal spines in *A. commbrae*, and also in *A. luelingi*, is indicative of the inappropriateness of anal spine count alone as generic character in the Cichlidae.

REFERENCES

- AHL, E. 1931. Neue Süßwasserfische aus dem Stromgebiet des Amazonenstromes. *Sber. Ges. naturf. Freunde Berl.* 1931: 206-212.
- 1939. Über zwei neue Fische der Familie Cichlidae aus dem Zoologischen Museum Berlin. *Zool. Anz.* 127: 80-82.
- BERTONI, A. DE WINKELRIED. 1914. Fauna Paraguaya. Catálogos sistemáticos de los vertebrados del Paraguay. Peces, batracios, reptiles, aves y mamíferos conocidos hasta 1913. In BERTONI, M. S. (ed.) *Descripción física y económica del Paraguay*. Num. nov. 59:1. Asunción, 86 pp.
- 1939. Catálogos sistemáticos de los vertebrados del Paraguay. *Revta Soc. cient. Paraguay* 4(4): 1-60.
- BONETTO, A. A., D. ROLDAN & M. E. OLIVER. 1978. Estudios limnológicos en la cuenca del Riachuelo (Corrientes, Argentina). I. Poblaciones de peces en ambientes lentíticos y lóticos. *Ecosur* 5 (9): 1-15.
- BOULENGER, G. A. 1895. Viaggio del dottor Alfredo Borelli nella Republica Argentina e nel Paraguay. XII. Poissons. *Boll. Musei Zool. Anat. comp. R. Univ. Torino* 10 (196): 1-3.
- 1900. Viaggio del Dr. Borelli nel Matto Grosso e nel Paraguay. III. Liste des poissons recueillis à Urucum et à Carandasiño, près de Corumbá. *Boll. Musei Zool. Anat. comp. R. Univ. Torino* 15 (370): 1-4.
- 1916. On specimens of the Perciform fish *Tilapia nilotica* with increased number of anal spines. *Proc. zool. Soc. Lond.* 1916: 345-347.
- EIGENMANN, C. H. 1909. The fresh-water fishes of Patagonia and an examination of the Archiplata-Archhelenis theory. *Rep. Princeton Univ. Exped. Patagonia Zool.* 3: 225-374.
- 1910. Catalogue of the fresh-water fishes of tropical and south temperate America. *Rep. Princeton Univ. Exped. Patagonia Zool.* 3: 375-511.
- 1912. The freshwater fishes of British Guiana, including a study of the ecological groupings of species, and the relation of the fauna of the plateau to that of the lowlands. *Mem. Carneg. Mus.* 5: 1-578.
- EIGENMANN, C. H., W. L. McATEE & D. P. WARD. 1907. On further collections of fishes from Paraguay. *Ann. Carneg. Mus.* 4: 110-157.
- FOWLER, H. W. 1932. Zoological results of the Matto Grosso Expedition to Brazil in 1931, — I. Fresh water fishes. *Proc. Acad. nat. Sci. Philad.* 84: 343-377.
- 1954. Os peixes de água doce do Brasil. Vol. II. *Archos Zool. Est. S Paulo* 9: 1-400.
- GOSSE, J.-P. 1976. Révision du genre *Geophagus*. *Mém. Acad. r. Sci. d'outre-mer. Cl. Sci. nat. méd. N.S.* 19 (3): 1-172.
- GREENWOOD, P. H. 1979. Towards a phyletic classification of the "genus" *Haplochromis* and related taxa. Part. I. *Bull. Br. Mus. nat. Hist. (Zool.)* 35: 265-322.
- HASEMAN, J. D. 1911. An annotated catalog of the cichlid fishes collected by the Expedition of the Carnegie Museum to Central South America, 1907-10. *Ann. Carneg. Mus.* 7: 329-373.
- 1912. Some factors of geographical distribution in South America. *Ann. N. Y. Acad. Sci.* 22: 9-112.

- HOLLY, M., H. MEINKEN & A. RACHOW. 1925-1964. *Die Aquarienfische in Wort und Bild*. Stuttgart. Loose-leaf system.
- IHERING, R. VON. 1907. Os peixes da agua doce do Brazil. *Revta Mus. paul.* 7: 258-336.
- INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE. 1964. Second ed., London, 176 pp. And: *Bull. zool. Nom.* 31: 77-101.
- KULLANDER, S. O. 1976. *Apistogramma luelingi* sp. nov., a new cichlid fish from Bolivia. *Bonn. zool. Beitr.* 27: 258-266.
- 1979a. Species of *Apistogramma* from the Orinoco drainage basin, South America, with descriptions of four new species. *Zool. Scr.* 8: 69-79.
 - 1979b. Description of a new species of the genus *Apistogramma* from Peru. *Revue suisse Zool.* 86: 937-945.
 - 1980a. A taxonomical study of the genus *Apistogramma* Regan, with a revision of Brazilian and Peruvian species. *Bonn. zool. Monogr.* 14: 152 pp.
 - 1980b. A redescription of the South American cichlid fish *Papiliochromis ramirezi* (Myers & Harry, 1948). *Stud. neotrop. Fauna Env.* 15: 91-108.
 - 1980c. Description of a new species of *Apistogramma* from the Rio Madeira system in Brazil. *Bull. zool. Mus. Univ. Amsterd.* 7 (16): 1-8.
 - 1981. Cichlid fishes from the La Plata basin. Part. I. Collections from Paraguay in the Muséum d'Histoire naturelle de Genève. *Revue suisse Zool.* 88: 675-692.
- LANGHAMMER, J. K. 1975. Some notes on the taxonomy of *Apistogramma*. *Buntbarsche Bull. (J. Am. Cichlid Assn.)* (46): 13.
- MEINKEN, H. 1937. Beiträge zur Fischfauna des mittleren Paraná III. *Bl. Aquar. - u. Terrarienk.* 48: 73-80.
- 1960. Eine neue *Apistogramma*-Art. *Int. Revue ges. Hydrobiol. Hydrograph.* 45: 655-661.
 - 1961a. Drei neu eingeführte *Apistogramma*-Arten aus Peru, eine davon wissenschaftlich neu. *Aquar.-u. Terrar.-Z.* 14: 135-139.
 - 1961b. *Apistogramma borellii* (Regan). *Aquar.-u. Terrar.-Z.* 14: 166-169.
 - 1962. Eine neue *Apistogramma*-Art aus dem mittleren Amazonas-Gebiet, zugleich mit dem Versuch einer Übersicht über die Gattung. *Senckenberg. biol.* 43: 137-143.
 - 1969. Zur Frage des Vorkommens von *Apistogramma ramirezi* Myers & Harry, 1948. *M Schr. Ornithol. Vivark. B Aquar. Terrar.* 16: 165-166.
- MITSCH, H. 1938. Die Zwergcichliden. *Aquarium Berl.* 1938: 180-181.
- MÜLLER, P. & G. WEIMER. 1976. Bemerkungen zu den Verbreitungszentren der südamerikanischen Callichthyiden und Cichliden. *Amazoniana* 6: 105-121.
- PEARSON, N. E. 1937. The fishes of the Beni-Mamoré and Paraguay basins, and a discussion of the origin of the Paraguayan fauna. *Proc. Calif. Acad. Sci.* (4) 23: 99-114.
- PELLEGRIN, J. 1904. Contribution à l'étude anatomique, biologique et taxinomique des poissons de la famille des Cichlidés. *Mém. Soc. zool. Fr.* 16: 41-399.
- 1936. Un poisson d'aquarium nouveau du genre *Apistogramma*. *Bull. Soc. natn. Acclin. Fr.* 83: 56-58.
- POZZI, A. J. 1945. Sistemática y distribución de los peces de agua dulce de la república Argentina. *Gaea, An. Soc. Argent. Estud. geogr.* 7: 239-292.
- REGAN, C. T. 1906a. A revision of the South-American cichlid genera *Retroculus*, *Geophagus*, *Heterogramma*, and *Biotocus*. *Ann. Mag. nat. Hist.* (7) 17: 49-66.
- 1906b. Erratum. *Ann. Mag. nat. Hist.* (7) 17: viii.
 - 1906c. A revision of the fishes of the South-American cichlid genera *Cichla*, *Chaetobranchus*, and *Chaetobranchopsis*, with notes on the genera of American Cichlidae. *Ann. Mag. nat. Hist.* (7) 17: 230-239.
 - 1909. Description of a new cichlid fish of the genus *Heterogramma* from the La Plata. *Ann. Mag. nat. Hist.* (8) 3: 270.

- REGAN, C. T. 1913. Fishes from the River Ucayali, Peru, collected by Mr. Mounsey, *Ann. Mag. nat. Hist.* (8) 12: 281-283.
- REITZIG, W. 1977. Der Schleier ist gelüftet: Der „reizigi“ stammt aus dem Rio Paraná. *Aquar. Mag.* 11: 288-289.
- RIBEIRO, A. DE MIRANDA. [1915]. Fauna Brasileira. Peixes V (Eletherobranchios Aspirophoros) Physoclisti. *Archos. Mus. nac., Rio de J.* 17:500 pp., pagination per family, Cichlidae 70 pp.
- 1918. Fauna brasileira — Peixes. V. Primeira parte. Terceira parte. *Archos Mus. nac., Rio de J.* 21: 1-227 (incl. index to RIBEIRO [1915] and 1918).
- RINGUELET, R. A., R. H. ARÁMBURU & A. ALONSO DE ARÁMBURU. 1967. *Los peces argentinos de agua dulce*. La Plata, 602 pp.
- TERRAZAS URQUIDI, W. 1970. Lista de peces bolivianos. *Publnes. Acad. nac. Cienc. Bolivia* 24: 65 pp.
- WHITEHEAD, P. J. P. 1962. The relationship between *Tilapia nigra* (Günther) and *T. mossambica* Peters in the eastern rivers of Kenya. *Proc. zool. Soc. Lond.* 138: 605-637.
- WICKLER, W. 1960. Über die systematische Stellung von „*Apistogramma*“ *ramirezi* Myers & Harry. *M Schr. Ornithol. Vivark. B Aquar. Terrar.* 7: 327-328.
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